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Title: Tile Glow Correction

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Tile Glow Correction

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Abstract
In analyzing experiment 955 camera data it has become apparent that the LSO tiles used in experiment 955 exhibit a feature that leads to a nearly flat background of light emitted from each of the tiles that is proportional to the number of protons incident on the tile. In this report I present a method of correcting for this phenomena.

Introduction

The active camera fielded for experiment 955 shows a dramatic improvement in performance over the gated cameras used in line C for dynamic radiography with regard to long-range blur. Measurements made using the Morley mask technique show the long rang blur is reduced in level (2.3% compared with 20%) and is much shorter range (5 mm compared to 10 mm) than measured with the line C diode gated cameras when the camera was backlit with a strobe light. A line out showing the long-range blur component is displayed in figure 1).

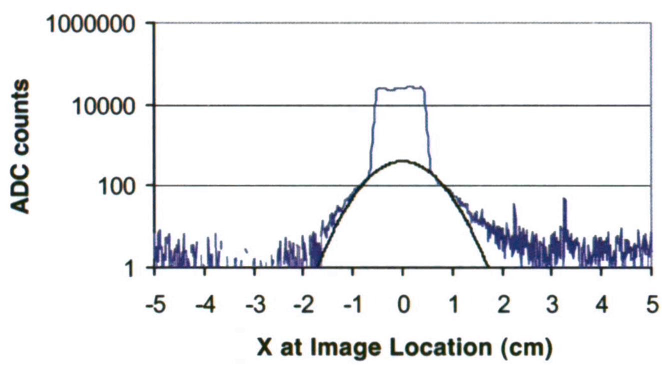

Figure 1 A Line out through the Morley mask is show in blue. The black line shows the 2.3% long range blur present in the Camera/lens system used for AGS experiment 955.

A method for correcting for the long-range blur has been described in a previous report.

A new effect can be observed in the data from experiment 955. This is a time correlated, position uncorrelated "glow" from the scintillator tiles. We have quantified the size of the glow by illuminating the image plane with a pencil beam made using an approximately 6 cm long 1 cm diameter (these dimensions need to be checked on) tungsten bar mounted in the beam at the object location. The ~18 mrad of multiple scattering in the tungsten resulted in a well defined spot in the image location. The DALIK was used to move the spot across the image plane. All of the pictures were processed to remove stars and a beam halo background, measured with nothing in the beam was subtracted from all of the pictures. An example of the result is given below in Figure 2)

A correction for tile glow is obtained by integrating the light within each tile boundary, calculating an average light level, L_{ij}, for each pixel within a given tile, and calculating a new picture, B_{ij}, from the old, A_{ij}, as $B_{ij}=(1+cf)\ A_{ij}-cf\ L_{ij}$ for each of the nine tiles. Figure 2 shows the result of applying this correction as a function of the size of *cf*. It is fairly easy to visually pick out the correct value for *cf* to a precision of ~1%.

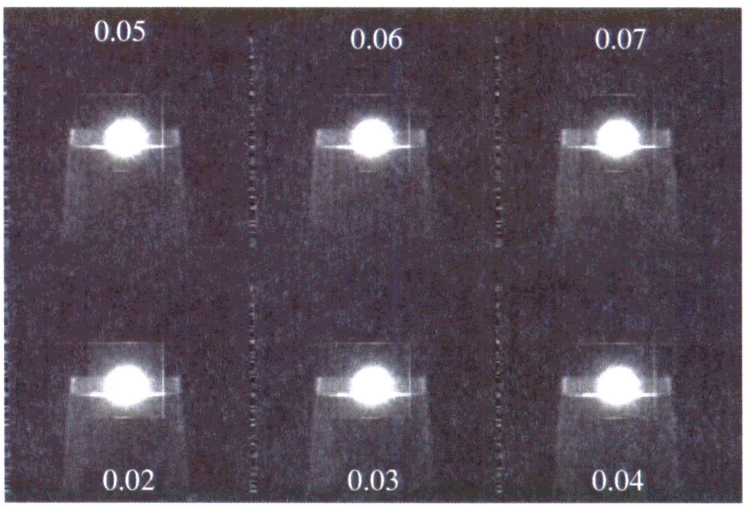

Figure 2 Pictures of the tungsten rod, mounted on a paper coffee, with different values of the correction factor applied for the tile glow correction. The glow, extending to the edges of the tile is clearly visible in the pictures. The flattest result is obtained with a correction factor of 0.05±0.01

Although the transmission through the tungsten rod is not saturated in the original picture the intensity scale has been arrange to observe the tile background. These data are remarkable in several regards. The coffee cup, which is clearly visible, has a transmission on the order of 0.7 % of the tungsten rod. The noise level in the rest of the radiograph is a level of about 0.1% of the tungsten transmission. This demonstrates the very large dynamic range of proton radiography with a Ferm collimator.

Conclusion

An effective method for measuring and correcting for a time correlated, position-uncorrelated background in the LSO tiles used for experiment 955 is presented. This correction is expected to reduce the tile glow background to levels below 1% in more complicated radiographs. We have also demonstrated the ability to simultaneously radiography a paper cup and a 6 cm thick tungsten rod using a Ferm collimator.